



## **CARBON DEBT ANALYSIS**

The proposed solar project area of disturbance (including panels, electrical equipment, access roads, and related ground clearing) is designed to cover approximately 17.19 acres of approximately 54.08 acres across the Project Site. About a 6.1-acre footprint of the proposed solar project consists of unforested terrain. In total, the project calls for 10.86 acres of tree clearing and an additional 0.97 acres of tree trimming for placement of the arrays and shade mitigation in select areas within the vicinity of the arrays. The tree clearing and trimming total 11.8 acres. There are demonstrable net benefits to the construction and operation of the solar Project which significantly offset the proposed 11.8 acres of clearing at the Site.

The United States Environmental Protection Agency (EPA) provides specific carbon sequestration data and conversion factor data to perform a Carbon Debt Analysis. As set forth in further detail herein, we will calculate and compare two carbon values by applying the prescribed sequestration data and conversion data. The first calculation establishes a baseline value as the “existing condition scenario.” This value is established by measuring the carbon sequestration capability of the Site without the proposed solar Project. The second calculation derives a value that is the “solar Project scenario.” This value is calculated based on the removal of 11.8 acres of vegetative cover and the installation of the proposed Project. This second value will be representative of the amount of carbon that will not be released from “typical” energy generating means due to the carbon free energy generation of the solar Project.

**Existing Condition Scenario:** The proposed solar project requires site work that will result in the removal of 11.8 acres of vegetation. According to the EPA’s “conversion factor for carbon sequestered in one year by one acre of average U.S. forest,” the amount of carbon sequestered in one year by one acre of forest is 0.84 metric tons of CO<sub>2</sub> (MT CO<sub>2</sub>) (EPA 2020). This means that the existing condition scenario will offer a “carbon debt” of 9.9 MT CO<sub>2</sub> annually (11.8 acres \* 0.84 MT CO<sub>2</sub>/acre).

**Solar Project Scenario:** The proposed solar project is calculated to produce 5,299 MWh of energy during the first operational year. According to the EPA Greenhouse gas electricity reduction equivalency conversion factor, 1 MWh of electricity is equivalent to a “carbon offset” of 1,562.4 lbs. of CO<sub>2</sub>. Therefore, the forecasted energy generation of 5,299 MWh is equivalent to a “carbon offset” of 3,701.8 MT CO<sub>2</sub> in the first year ((5,299 MWh\*1,540.1lbs CO<sub>2</sub>/MWh)/(2,204.6 lbs/MT)).

Analysis: In comparing the existing condition scenario offering a carbon debt of 9.9 MT CO<sub>2</sub> and the solar Project scenario offering a carbon offset of 3,701.8 MT CO<sub>2</sub> in the first year of generation, the following can be concluded:

(1) The installation of the solar project will have a net carbon offset of 1,221 MT CO<sub>2</sub> annually.

$$3,701.8 \text{ MT CO}_2 - 9.9 \text{ CO}_2 = 3,691.9 \text{ MT CO}_2$$



(2) The solar project will offer a net improvement in carbon reduction within 1 day of operation.

$$(9.9 \text{ MT CO}_2 / 3,701.8 \text{ MT CO}_2) * 365 \text{ days} = 0.98 \text{ days}$$

(3) The carbon offset from the solar project in a year is the equivalent of 4,322 acres of U.S. forests, which is approximately 366x the acres of forest that will be removed for this project.

$$4,322 \text{ acres U.S. forest} / 11.8 \text{ acres U.S. forest} = 366x$$

(4) It would take less than twenty (20) days to recover the loss of carbon sequestration by the 11.8 acres of cleared trees over 20 years.

$$\text{Carbon debt over 20 years} = 9.9 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 198 \text{ MT CO}_2$$

$$\text{Carbon offset over 20 years} = 3,701.8 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 74,036 \text{ MT CO}_2$$

$$198 \text{ MT CO}_2 / 74,036 \text{ MT CO}_2 * 20 \text{ years} * 365 \text{ days} = 19.5 \text{ days}$$

### Step 1 - Enter and convert data

Select data to convert: ⓘ

Energy data ⓘ

Emissions data

Enter data:

Unit	Amount
<input type="radio"/> Gallons of gasoline	
<input type="radio"/> Gasoline-powered passenger vehicles ⓘ	
<input checked="" type="radio"/> Kilowatt-hours avoided ⓘ	5299000
<input type="radio"/> Kilowatt-hours used ⓘ	
<input type="radio"/> MCF of natural gas	
<input type="radio"/> Therms of natural gas	

Convert data

Clear Fields



Step 2 - View results

3,702 Metric Tons of Carbon Dioxide (CO<sub>2</sub>) equivalent

This is equivalent to greenhouse gas emissions from:

881 gasoline-powered passenger vehicles driven for one year	9,467,678 miles driven by an average gasoline-powered passenger vehicle
---	---

This is equivalent to CO<sub>2</sub> emissions from:

416,544 gallons of gasoline consumed	363,637 gallons of diesel consumed
4,079,700 pounds of coal burned	49 tanker trucks' worth of gasoline
483 homes' energy use for one year	731 homes' electricity use for one year
20.4 railcars' worth of coal burned	8,571 barrels of oil consumed
170,059 propane cylinders used for home barbeques	0.001 coal-fired power plants in one year
0.01 natural gas-fired power plants in one year	244,382,494 number of smartphones charged

This is equivalent to greenhouse gas emissions avoided by:

1,285 tons of waste recycled instead of landfilled	184 garbage trucks of waste recycled instead of landfilled
160,792 trash bags of waste recycled instead of landfilled	0.974 wind turbines running for a year

This is equivalent to carbon sequestered by:

61,210 tree seedlings grown for 10 years	4,322 acres of U.S. forests in one year
23.7 acres of U.S. forests preserved from conversion to cropland in one year	

References:

U.S. Environmental Protection Agency (EPA) 2021. Greenhouse Gases Equivalencies Calculator - Calculations and References.

<https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

<https://www.nrel.gov/docs/fy13osti/56487.pdf>